[DOCUMENT NAME] CLAIMS

[CLAIM 1]

An electrode structure of a plasma processing apparatus for plasmatizing a processing gas in a discharge space and jetting the plasmatized gas so as to be contacted to a workpiece to be processed, said electrode structure forming said discharge space in said apparatus, said electrode structure comprising:

a first electrode row including a plurality of electrode members each having a length shorter than that of said workpiece and arranged in a side-by-side relation in one direction, said first electrode row as a whole having a length corresponding to that of said workpiece;

a second electrode row including another plurality of electrode members each having a length shorter than that of said workpiece and arranged in a side-by-side relation with each other and in a parallel relation with said first electrode row, said second electrode row as a whole having a length corresponding to that of said workpiece;

one of said electrode members of said first electrode row and one of said electrode members of said second electrode rows, which are arranged in substantially same positions in the side-by-side arranging directions, having opposite polarities and forming a row-to-row partial gap therebetween, said row-to-row partial gap serving as a part of said discharge space; and

a row-to-row gap including said row-to-row partial gap between said first and second electrode rows, said row-to-row gap having a length corresponding to that of said workpiece.

[CLAIM 2]

An electrode structure of a plasma processing apparatus according to claim 1, wherein said polarities include an electric field applying pole and a grounding pole, only those of said electrode members constituting said

electric field applying pole being connected to different power sources, respectively.

[CLAIM 3]

An electrode structure of a plasma processing apparatus according to claim 1, wherein said polarities include an electric field applying pole and a grounding pole, only those of said electrode members constituting said electric field applying pole being connected to a common power source.

[CLAIM 4]

An electrode structure of a plasma processing apparatus for plasmatizing a processing gas in a discharge space and jetting the plasmatized gas so as to be contacted to a workpiece to be processed, said electrode structure forming said discharge space in said apparatus, said electrode structure comprising:

a first electrode row including a plurality of electrode members arranged in a side-by-side relation in one direction;

a second electrode row including another plurality of electrode members arranged in a side-by-side relation with each other and in a parallel relation with said first electrode row;

one of said electrode members of said first electrode row and one of said electrode members of said second electrode rows, which are arranged in substantially same positions in the side-by-side arranging directions, having opposite polarities and forming a row-to-row partial gap therebetween, said row-to-row partial gap serving as a part of said discharge space;

a row-to-row gap including said row-to-row partial gap formed between said first and second electrode rows; and

two of said electrode members of each of said electrode rows arranged adjacent to each other in said side-by-side arranging directions being opposite in polarity with respect to each other.

[CLAIM 5]

An electrode structure of a plasma processing apparatus according to claim 4, wherein an in-row gap is formed between two of said electrode members arranged adjacent to each other in said side-by-side arranging directions in said first electrode row and/or said second electrode row, said in-row gap also forming a part of said discharge space.

[CLAIM 6]

An electrode structure of a plasma processing apparatus according to claim 5, wherein one of said two electrode members includes a first surface forming said row-to-row gap and a second surface disposed at an angle with respect to said first surface, and the other of said two electrode members includes a third surface generally flush with said first surface and forming said row-to-row gap and a fourth surface placed opposite to said second surface and arranged at an angle with respect to said third surface, said in-row gap being formed between said second surface and said fourth surface.

[CLAIM 7]

An electrode structure of a plasma processing apparatus according to claim 6, wherein said first surface and second surface form an obtuse angle and said third surface and fourth surface form an acute angle, said in-row gap being in a slantwise relation with said row-to-row gap.

[CLAIM 8]

An electrode structure of a plasma processing apparatus according to claim 7, wherein corners on the side of the obtuse angle formed between said first surface and second surface are R-chamfered with a relatively large radius of curvature, while corners on the side of the acute angle formed between said third surface and fourth surface are R-chamfered with a relatively small radius of curvature.

[CLAIM 9]

An electrode structure of a plasma processing apparatus according to claim 7, wherein in said electrode row on the opposite side of said electrode

row having said first surface, said electrode member located in the substantially same position as said electrode member having said first surface is arranged astride said first surface and the end face of said third surface.

[CLAIM 10]

An electrode structure of a plasma processing apparatus according to claim 7, wherein the downstream end of said in-row gap is open in such a manner as to be able to jet a processing gas therefrom and without passing the processing gas through said row-to-row gap.

[CLAIM 11]

An electrode structure of a plasma processing apparatus for plasmatizing a processing gas in a discharge space and jetting the plasmatized gas so as to be contacted to a workpiece to be processed, said electrode structure forming said discharge space in said apparatus, said electrode structure comprising:

a first electrode row including a plurality of electrode members arranged in a side-by-side relation in one direction;

a second electrode row including another plurality of electrode members arranged in a side-by-side relation with each other and in a parallel relation with said first electrode row;

one of said electrode members of said first electrode row and one of said electrode members of said second electrode rows, which are arranged in substantially same positions in the side-by-side arranging directions, having opposite polarities and forming a row-to-row partial gap therebetween, said row-to-row partial gap serving as a part of said discharge space;

a row-to-row gap including said row-to-row partial gap formed between said first and second electrode rows; and

two of said electrode members of each of said electrode rows arranged adjacent to each other in said side-by-side arranging directions being same in polarity with respect to each other.

[CLAIM 12]

An electrode structure of a plasma processing apparatus according to claim 11, wherein said polarities include an electric field applying pole and a grounding pole, and an insulating partition wall is interposed between two of said electrode members having said electric field applying pole which are adjacent to each other in said side-by-side arranging directions.

[CLAIM 13]

A plasma processing apparatus for introducing a processing gas into a discharge space from an introduction port, plasmatizing the gas in said discharge space and jetting the plasmatized gas through a jet port so as to be contacted to a workpiece to be processed, said apparatus comprising:

an electrode structure including a first electrode row consisting of a plurality of electrode members arranged in a side-by-side relation in a direction intersecting with a direction toward said jet port from said introduction port, and another plurality of electrode members arranged in a side-by-side relation with each other and in parallel with said first electrode row; and

one of said electrode members of said first electrode row and one of said electrode members of said second electrode rows, which are arranged at a first position in said side-by-side arranging directions, having opposite polarities and forming a first row-to-row partial gap therebetween, said first row-to-row partial gap serving as a part of said discharge space, and another of said electrode members of said first electrode row and another of said electrode members of said second electrode rows, which are arranged at a second position adjacent to said first position having opposite polarities with each other and forming a second row-to-row partial gap therebetween, said

second row-to-row partial gap serving as another part of said discharge space;

said apparatus further comprising a gas guide which guides a processing gas flow passing through a part near said second position in said first row-to-row partial gap to a boundary between said first position and said second position or in a direction toward said second position.

[CLAIM 14]

A plasma processing apparatus according to claim 13, wherein said first row-to-row partial gap is provided inside said part near said second position with a gas guiding member, as said gas, having a gas guiding surface slanted toward said second position.

[CLAIM 15]

A plasma processing apparatus according to claim 14, wherein said gas guiding member is provided on said jet port side from said gas guiding surface with a gas return surface slanted in an opposite direction to said gas guiding surface.

[CLAIM 16]

A plasma processing apparatus according to claim 13, further comprising an introduction port forming part for forming said introduction port,

said gas guide being disposed at said introduction port forming part.

[CLAIM 17]

A plasma processing apparatus according to claim 16, wherein said introduction port of said introduction port forming part includes a branch port leading to said part near said second position of said first row-to-row partial gap, said branch port being disposed toward said second position thereby constituting said gas guide.

[CLAIM 18]

A plasma processing apparatus according to claim 16, wherein a flow rectification plate, as said gas instruction means, slanted toward said second position is received in said introduction port of said introduction port forming part at a position corresponding to said part near said second position of said first row-to-row partial gap.

[CLAIM 19]

A plasma processing apparatus according to claim 13, wherein said gas guide includes a blocking part for blocking an end part on said introduction port side located at the boundary between said first row-to-row partial gap and said second row-to-row partial gap and opening the area on the jet port side therefrom.

[CLAIM 20]

A plasma processing apparatus according to claim 19, further comprising an introduction port forming part for forming said introduction port,

said introduction port of said introduction port forming part having a slit-like configuration extending in said side-by-side arranging directions and disposed astride said first row-to-row part gas and said second row-to-row partial gap, said blocking part being received in said introduction port at a position corresponding to said boundary between said first row-to-row partial gap and said second row-to-row partial gap.

[CLAIM 21]

A plasma processing apparatus according to claim 19, wherein said electrode structure comprises a spacer having a pair of interposing parts and a connection part for connecting said interposing parts, one of said interposing parts being sandwiched between said electrode member located at said first position and said electrode member located at said second position in said first electrode row, the other of said interposing parts being sandwiched between said electrode member located at said first position and

said electrode member located at said second position in said second electrode row, said connection part being arranged close to the end part on said introduction port side of said boundary, thereby being provided as said blocking part.

[CLAIM 22]

A plasma processing apparatus according to claim 13, further comprising a jet port forming part for forming said jet port,

said gas guide being disposed at said jet port forming part and introducing a processing gas coming from said part near said second position of said first row-to-row partial gap toward said second position.

[CLAIM 23]

A plasma processing apparatus according to claim 22, wherein said gas guide includes a gas guiding surface inclined in a second direction and arranged at a position corresponding to said part near said second position of said first row-to-row partial gap in said jet port of said jet port forming part.

[CLAIM 24]

A plasma processing apparatus according to claim 22, wherein said gas guide is arranged at a position corresponding to the boundary between said first row-to-row partial gap and said second row-to-row partial gap in said jet port of said jet port forming part in such a manner as to be close to said electrode structure side, and said gas guide includes a blocking part for blocking the end part on said jet port side of said boundary.

[CLAIM 25]

A plasma processing apparatus according to claim 22, wherein said jet port forming part includes a porous plate, a processing gas coming from said first row-to-row partial gap being dispersed and thus, diffused also toward said second position and jetted out, thereby providing said porous plate as said gas guide.

[CLAIM 26]

A plasma processing apparatus according to claim 22, wherein a part of said jet port of said jet port forming part corresponding to said boundary between said first row-to-row partial gap and said second row-to-row partial gap is larger in opening width than another part of said jet port of said jet port forming part corresponding to said first row-to-row partial gap, and said former part having the large opening width is provided as said gas guide.
[CLAIM 27]

A plasma processing apparatus for introducing a processing gas into a discharge space from an introduction port, plasmatizing the gas in said discharge space and jetting the plasmatized gas through a jet port so as to be contact to a workpiece to be processed, said apparatus comprising:

an electrode structure including a first electrode row consisting of a plurality of electrode members arranged in a side-by-side relation in a direction intersecting with a direction toward said jet port from said introduction port, and another plurality of electrode members arranged in a side-by-side relation with each other and in parallel with said first electrode row; and

one of said electrode members of said first electrode row and one of said electrode members of said second electrode rows, which are arranged at a first position in said side-by-side arranging directions, having opposite polarities and forming a first row-to-row partial gap therebetween, said first row-to-row partial gap serving as a part of said discharge space, and another of said electrode members of said first electrode row and another of said electrode members of said second electrode rows, which are arranged at a second position adjacent to said first position having opposite polarities with each other and forming a second row-to-row partial gap therebetween, said second row-to-row partial gap serving as another part of said discharge space, said electrode member which is arranged at the first position in said first electrode row and said electrode member which is arranged at the

second position in said first electrode row having opposite polarities each other and forming an in-row gap therebetween;

said apparatus further comprising an introduction port forming part for forming said introduction port; and

said introduction port of said introduction port forming part including a row-to-row introduction port disposed astride said first row-to-row partial gap and said second row-to-row partial gap and an in-row introduction port directly connected to said in-row gap.

[CLAIM 28]

A plasma processing apparatus comprising an electric field applying electrode and a grounding electrode which are placed opposite to each other and form a processing gas path therebetween, a plurality of power source devices for applying an electric field for plasmatizing said processing gas between said electrodes, and a synchronizer which synchronizes said power source devices.

[CLAIM 29]

A plasma processing apparatus according to claim 28, wherein said plurality of power source devices each include a rectification path for rectifying a commercial-use AC voltage to a DC voltage, and an inverter for switching the DC voltage after rectification to an AC voltage by a switching element, said synchronizer controlling said inverters for said power source devices such that said inverters are synchronized in switching action with each other.

[CLAIM 30]

A plasma processing apparatus according to claim 29, wherein said synchronizer includes a common gate signal output part for said inverters of said power source devices, a gate signal outputted from said gate signal output part being inputted in a gate of said switching element of each of said inverters in parallel.

[CLAIM 31]

A plasma processing apparatus according to claim 29, wherein said synchronizer includes a plurality of gate signal output parts which are provided to said inverter of each power source device and a common synchronization signal supply part for said gate signal output parts, a synchronization signal outputted from said synchronization signal supply part being inputted into each of said gate signal output parts in parallel so that in response to input of said synchronization signal, said gate signal output parts each input a gate signal into said gate of said switching element of the corresponding inverter.

[CLAIM 32]

A plasma processing apparatus comprising:

an electric field applying electrode including a first and a second divided electrode member;

a grounding electrode for forming a processing gas path between said first and second electric field applying electrodes;

a first power source device for applying an electric field for plasmatizing said processing gas between said first divided electrode member and said grounding electrode;

a second power source device for applying an electric field for plasmatizing said processing gas between said second divided electrode member and said grounding electrode; and

a synchronizer which synchronizes said first and second power source devices.

[CLAIM 33]

A plasma processing apparatus according to claim 32, wherein electrostatic capacity between said first divided electrode member and said grounding electrode is larger than that between said second divided electrode member and said grounding electrode, and

said second electrode device is longer in rising/falling time of applied voltage than said first power source device.

[CLAIM 34]

A plasma processing apparatus according to claim 32, wherein electrostatic capacity between said first divided electrode member and said grounding electrode is larger than that between said second divided electrode member and said grounding electrode, and

said second divided electrode member is connected with a condenser in parallel.